4th ANNUAL RED RIVER BASIN LAND AND WATER INTERNATIONAL SUMMIT CONFERENCE

WATER QUALITY ALERT LEVELS

RED RIVER POLLUTION BOARD - INTERNATIONAL JOINT COMMISSION

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1.0 Introduction

In the late sixties, the governments of the United States and Canada requested the International Joint Commission (IJC) to "establish continuous supervision over the quality of waters crossing the boundary in the Red River and to recommend amendments or additions to the Objectives when considered warranted by the Commission". Subsequently, and under an IJC Directive of 1969, the Red River Pollution Board was born and has continued to this day under the chairpersonship of a Canadian and United States member. The Board consists of a member from each of Manitoba Department of the Environment Workplace Health and Safety, Minnesota Pollution Control Agency, North Dakota State Health Department, United States Environmental Protection Agency (Co-chair) and Environment Canada (Co-chair).

In the 1969 Directive to the Board, the IJC formally established water quality objectives (Table 1.0) for total dissolved solids, Fecal coliform, sulphate, dissolved oxygen and chlorides, which the governments agreed if not exceeded in the Red River would define acceptable levels of water quality for downstream water uses satisfying the Boundary Waters

Treaty of 1909). This short presentation focusses on water quality objectives, the RRPB Alert Levels an the monitoring performed at the International Boundary of the Red River.

Table 1.0. IJC Red River Water Quality Objectives (Adopted 1969)

Parameter	IJC Objective
Total Dissolved Solids	500 mg/L
Chloride	100 mg/L
Dissolved Oxygen	5.0 mg/L
Fecal Coliforms	200 Col/100 ml
Sulphates	250 mg/L

2.0 Concept of Water Quality Objectives

To appreciate the purpose and application of Alert Levels requires an understanding of what Water Quality Objectives are. As used by the Red River Pollution Board (RRPB), Objectives are concentrations or narrative statements based on scientific criteria, existing quality and other factors, which have been negotiated to protect designated uses of water and only for those parameters which constitute actual or potential water quality problems. The Objectives used by the RRPB apply only to those waters crossing the international boundary of the Red River. These numbers are not legally binding although they represent a level of quality the governments agree to build their respective pollution control strategies around in order to improve the bacterial, oxygen and salinity quality of the Red River. In addition to the traditional approach of establishing chemical concentrations, objectives could also involve physical and biological considerations of the aquatic ecosystem.

3.0 Concept of Water Quality Alert Levels

An Alert Level approach has been adopted by the Board to assist it in identifying water quality trends and issues (early warning) and recommending candidate parameters for formal Water Quality Objectives. Alert Levels are chemical, physical or biological concentration or effects which if not met, alerts the Board and its member agencies to potentially undesirable water quality conditions which should be investigated in the context of the uses being supported by the Red River downstream in Canada. Where the follow-up investigations reveal that improvements are indeed needed in the United States, the Red River Pollution Board will advance to the IJC, for its consideration and recommendation to governments, revised or new Water Quality Objectives, developed on the basis of excursions to the Alert Levels and on the basis of other scientific information. The Red River Pollution Board Alert Levels (Appendix A) are pseudo Water Quality Objectives.

The Alert Levels used by the Red River Pollution Board differ from the IJC Water Quality Objectives in one very important way:

> Alert levels are not targets formally adopted by the IJC or governments. They are strictly a monitoring 'yard stick' to assist the Red River Pollution Board to meet its mandate.

The constituents selected for inclusion in the list of Alert Levels was made on the basis that Alert Levels should be restricted to constituents whose levels might be influenced by the existing or predicted land and

water use activities. Each constituent was considered individually before a number was arrived at and an Alert Level established. Consideration was also given to the nature of the existing monitoring technology, programs of the agencies and the ambient water quality. The Board requires that wherever possible, Alert Levels should take into account flow patterns, seasonality of the constituents, knowledge of antagonistic and synergistic effects, biological measures of aquatic quality and surrogate measurements. Adoption of the Alert Levels does not preclude the need for additional study of the validity of the numbers; it is intended that the numerical Alert Levels and the list of constituents be reviewed periodically and updated on the basis of new scientific and technological information; the whole concept of Water Quality Objectives and Alert Levels is in its infancy and is continuing to evolve.

4.0 Why Alert Levels in Addition to Water Quality Objectives?

Water Quality Objectives have traditionally been set by agencies for virtually all substances which could be easily determined analytically. The Board initially considered requesting the approval of the IJC for formalizing a wide spectrum of such chemical-oriented water quality objectives. However, it decided that this would abuse the purpose of the IJC Objectives as it felt that Objectives should only be formalized when there is a known water quality problem which can be actively redressed through the application of Objectives. But the Board still needed a

first line of defence against water quality issues going unnoticed until it was too late for agencies to evoke cost effective pollution control measures. Since considerable information exists in the literature concerning acute and chronic toxicity, the first line of defence adopted by the Board was the Alert Level concept, indicators of acceptable water quality which if exceeded identified possible issues.

The Board recognizes that the Alert Levels have their limitations as would any numbers set forth for the same purpose. Numbers formulated today will be different than those formulated five years from now simply because our understanding of how aquatic ecosystems respond to pollutants in the environment is increasing day by day. This, however, should not deter the formulation of Alert Levels since vigilance today can lead to better quality water for the future and aid avoiding international disputes. Ongoing evaluation, review and updating of the Alert Levels must be an active administrative process and not simply a statement of intent.

5.0 How are Objectives and Alert Levels Used by the RRPB?

Water Quality Objectives and Alert Levels used by the Board have received the endorsement of the member agencies of the Board. As such, they aid in avoiding conflicts by securing the cooperation and commitment of all parties towards collective consideration and resolution of water quality problems on the Red River which have an international dimension. Most

importantly, these negotiated environmental indicators have provided the opportunity for many jurisdictions to reach agreement on the quality of water which should be respected at the transboundary location in order to achieve an equitable sharing of the aquatic resource. These water quality management tools provide a yardstick with which to assess quality, identify issues and target the energies of the monitoring agencies on those parameters most deserving of attention. Objectives and Alert Levels are complimentary in their application and form environmental indicators which when compared to ambient water quality can provide managers with important information before undesirable conditions become irreversible. These environmental indicators act as a deterrent to indiscriminant discharges and can provide a rational basis for site-specific stream and effluent standards.

6.0 Monitoring the Quality of the Red River Boundary Waters

The Red River Pollution Board provides a forum for the agencies to discuss water quality problems (past, present and future), pollution control initiatives, and monitoring activities within the Red River Basin which have relevance to the quality of the transboundary waters. The Board on occasion recommends monitoring or synoptic surveys which should be undertaken by one or more of its member agencies. The Alert Levels themselves create a framework around which much of the monitoring is performed, particularly the monitoring at the boundary location.

Environment Canada conducts continuous surveillance of the Red River transboundary water with an automatic water quality monitor located at Emerson, Manitoba. This Schneider Robot monitor has been in operation since 1969, has documented trends and spill situations, contributed data for pollution control agencies to evoke pollution enhancement initiatives and has provided early warning of deteriorated water quality to downstream water users. A report detailing the operation of the monitor and identifying trends in water quality as measured by this monitor is under preparation by Environment Canada. Quarterly and monthly water sampling is conducted by the United States Geological Survey and Environment Canada, respectively, for a wide spectrum of water quality variables (Table 2.0). Recently, Environment Canada completed studies investigating the phosphorous and nitrogen forms in the Red River and their temporal variability and seasonal abundance (Chacko, 1984). The Province of Manitoba conducts periodic biological monitoring of tissue concentrations for trace metals and selected organic substances.

Table 2.0. Monitoring Program Red River at Emerson

Physical Parameters	Major Chemical Constituents	
Alkalinity	Bicarbonate	
BOD, COD or TOC	Calcium	
Colour	Carbonate	
Conductance	Chloride	
Discharge	Fluoride	
Hardness	Magnesium	
pH	Potassium	
Residues	Silicate	
Sodium Adsorption Ratio	Sodium	
Sodium Percent	Sulphate	
Sum of Ions	Carbon forms	
Temperature	Nitrogen forms	
Turbidity	Phosphorous forms	
Dissolved Gases	**Metals/Minor Elements**	
Ammonia-total, unionized	Arsenic	Manganese
Carbon dioxide	Barium	Mercury
Oxygen	Boron	Nickel
	Cadmium	Selenium
Organic Compounds	Chromium	Silver
	Cobalt	Vanadium
Chlorophenoxy acids	Copper	Zinc
Organo chlorine cpds	Iron	
Carbamates	Lead	
Organo phosphorous cpds		
Neutral herbicides		
Phenols		
Biological		
Coliform, fecal	Fish species	
Coliform, total	Fish tissue	
Chlorophyll		

Only five parameters are continuously monitored by the Robot Monitor: dissolved oxygen, conductivity, temperature, pH and chlorides. The data are available on a real time basis through linkages to the Geostationary Satellite and a regional computer located in Regina, Saskatchewan. On a

monthly basis, the data are transformed into daily mean values, mean monthly values, and graphical presentations (a sample of this report appears as Appendix B) and is distributed to member agencies. The Robot monitor data are supplemented with monthly grab sample data for approximately forty additional parameters, the information from which are included in the monthly monitor reports. These data are compared to the Objectives and Alert Levels and all excursions assessed by the Board, action taken as appropriate by member agencies and a report prepared to the International Joint Commission.

7.0 Summary

In summary, Water Quality Alert Levels are a monitoring tool, established to alert jurisdictions to potentially undesirable water quality conditions and, they are complementary to the IJC Water Quality Objectives. If exceeded, Alert Levels will trigger investigative action on the part of the Board or its member agencies. The exceedence, a term adopted by the Board to describe a situation where an Objective or an Alert Level is not met, is investigated in terms of its magnitude, implications to water uses and possible resolution. Water Quality Alert Levels, for a wide range of parameters, were adopted by the Red River Pollution Board in 1986 and are subject to revision on the basis of new information concerning ambient water quality, water uses, pollution sources and scientific criteria.

8.0 References and Additional

1. International Red River Pollution Board, Annual Reports to the International Joint Commission, available from member agencies of the Board.

2. Chacko, V. T., B. Chu and Wm. D. Gummer, 1984. Seasonal Variation of Nitrogen and Phosphorus Species in the Red River.

3. Guilbault, R. A., 1981. Trends in the Quality of the Red River at Emerson, Manitoba.

4. Hydroqual Consultants Inc., 1986. In publication, Water Quality Trend Analysis for the Red River at Emerson, prepared for the Water Quality Branch, Environment Canada.

5. Lewis, G. and Wm. Gummer, 1986. Approaches to Interjurisdictional Water Management - A Discussion Paper.

6. Environment Canada and Saskatchewan Environment, 1986. Proceedings of the Western and Northern August 1985 Workshop on Water Quality Objectives.

Unless otherwise noted, the above references or documents can be obtained from or viewed at, the Environment Canada office, 501 University Crescent, Winnipeg, Manitoba.

APPENDIX A

WATER QUALITY OBJECTIVES -- RED RIVER

Parameter	Minnesota	North Dakota	Manitoba	IJC Current	IJC Proposed	Origin/Rationale
Fecal Coliforms	200/100 ml geometric mean 10% of samples not to exceed 2,000 based on a minimum of 5 samples in a 30 day period from Mar. 1 - Oct. 31.	200/100 ml geometric mean L 400 in 10% of samples based on a minimum of not less than 5 samples in a 30 day period from May 1 - Sept. 30.	100/100 ml. At least 90% of samples in any consecutive 30 day period should have a fecal coliform density of less than 100 per 100 ml.	200/100 ml	200/100 ml geometric mean with 10% of samples not to exceed 400 based on min. 5 samples - 30 day period - May 1 - Oct. 31 and for the balance of year not to exceed 1000/100 ml	Origin in Minnesota and N.D. based on primary body contact recreation.
	Chemical Characteristics					
Chloride	100 mg/l	100 mg/l	100 mg/l	100 mg/l	100 mg/l	All agencies based on industrial consumption.
Fluoride	1.5 mg/l	None	1.0 mg/l	None	1.5 mg/l	Minnesota based on domestic consumption.
pH	6.5 - 9.0	7.0 - 8.5	6.5 - 9.0	None	6.5 - 9.0	All agencies based on protection of aquatic life.
Sulphate	250 mg/l	250 mg/l	250 mg/l	250 mg/l	250 mg/l	All agencies based on domestic consumption.
TDS	500 mg/l	None	1000 mg/l	500 mg/l	500 mg/l	All agencies excluding N.D. based on domestic consumption.
	Dissolved Gas					
Ammonia (N) (unionized)	.04 mg/l as N (warm water)	.02 mg/l	.02 mg/l	None	.04 mg/l as N	Minnesota, Manitoba for protection of aquatic life. Manitoba, Minnesota, N.D. current IJC for the protection of aquatic life
Dissolved Oxygen	5 mg/l (minimum)	67% saturation or more	67% saturation or more	5 mg/l (Minimum)	5 mg/l (Minimum)	
	Parameter					
PCB's	None	.001 ug/l	.002 ug/l	None	Not detectable in water, in fish total PCB's not exceeding 2 micrograms per gram of whole fish flesh sample.	Body burden: Canada and N.D. for protection of aquatic life, animal life and human life. Water: Manitoba for protection of aquatic life.
	Metals TOTAL					
Barium	1000 ug/l	1000 ug/l	1000 ug/l	None	1000 ug/l	All agencies based on domestic and industrial consumption.
Cadmium	10 ug/l	10 ug/l	10 ug/l (total)	None	10 ug/l	All agencies based on domestic consumption.
Chromium	50 ug/l	50 ug/l	50 ug/l (total)	None	50 ug/l	All agencies based on domestic consumption.
Copper	10 ug/l	50 ug/l	20 ug/l	None	10 ug/l	Minnesota for protection of aquatic life.
Iron	300 ug/l	None	300 ug/l	None	300 ug/l (dissolved)	Manitoba, Minnesota domestic consumption.
Lead	50 ug/l	50 ug/l	30 ug/l	None	50 ug/l	All agencies based on domestic consumption.
Manganese	50 ug/l	None	50 ug/l	None	50 ug/l	Minnesota and Manitoba based on domestic consumption.
Mercury	None	2 ug/l	.2 ug/l	None	.2 ug/l	Manitoba for protection of animal life and humans as a result of bioconcentrations in tissue in food chain.
Nickel	None	None	25 ug/l	None	25 ug/l	Manitoba for the protection of aquatic life.
Selenium	10 ug/l	10 ug/l	10 ug/l	None	10 ug/l	Minnesota and Manitoba on domestic consumption.
Silver	None	None	50 ug/l	None	50 ug/l	Manitoba based on domestic consumption.
Zinc	5000 ug/l	1000 ug/l	2000 ug/L or .01 of the 96 hour LC 50 value	None	1000 ug/l	N.D. based on domestic consumption. More restrictive criteria may be necessary to protect fish and aquatic life based on bio-assays.
	Nutrients					
Nitrates (N)	10 mg/l (total)	1.0 mg/l (dissolved)	10 mg/l (total)	None	10 mg/l (total)	Minnesota and Manitoba based on domestic consumption.

WATER QUALITY OBJECTIVES — RED RIVER (CONTINUED)

Parameter	Minnesota	North Dakota	Manitoba (Proposed)	IJC Current	IJC Proposed	Origin/Rational
Pesticides	Not listed	Not listed	Not listed	None	Persistent pest control and other persistent organic contaminants that are toxic or harmful to human, animal or aquatic life should be substantially absent in the Red River and from whole fish samples collected from the Red River. (substantially absent is defined as less than the detection limits of the best available scientific analytical method.) In addition, the following specific pesticides/herbicides should not exceed the specified limits in water: Total BHC (benzene hexachloride) family (Lindane) - 0.2 ug/l Toxaphene - 0.1 ug/l Total 2,4-D family - 4 ug/l Total 2,4,5-T family - (Silvex) - 2 ug/l	Manitoba for the protection of human, animal and aquatic life.
Colour (true platinum cobalt scale	15 (true)	None	15 (true)	None	15 (true)	Manitoba, Minnesota based on domestic consumption.
Turbidity (NTU)	25	None	25	None	25	Manitoba, Minnesota for domestic consumption and protection of aquatic life.
	Toxic Substances					
Arsenic	10 ug/l (total)	50 ug/l (total)	10 ug/l	None	10 ug/l (total)	Minnesota, Manitoba to protect human consumption.
Boron	500 ug/l	500 ug/l	300 ug/l	None	500 ug/l (total)	Minnesota, North Dakota based on irrigation water.
Cyanide	10 ug/l (total)	5 ug/l (total)	5 ug/l	None	5 ug/l (total)	Manitoba, North Dakota for protection of aquatic life.
Phenolics	100 ug/l	10 ug/l	1 ug/l	None	10 ug/l in water	North Dakota to protect against taste and odour in water and fish.
Oils & Greases	10 mg/l oil	Not listed	Not listed	None	No visible sheen on the surface.	All agencies based on aesthetics, taste and odour in water and fish. Also bathing.
Tainting Substances	Not listed	Not listed	Not listed	Not listed	No substance that causes fish flesh tainting.	North Dakota, Minnesota and Manitoba to protect against taste and odour problems in fish.

APPENDIX C

Environment Canada Environnement Canada

MEMORANDUM NOTE DE SERVICE

1985-1-31

FROM: / DE:
WATER QUALITY BRANCH
1-33 FRESHWATER INSTITUTE
501 UNIVERSITY CRESCENT
WINNIPEG, MANITOBA, CANADA.
R3T 2N6

TO: / À: See 'DISTRIBUTION' list

SUBJECT: / SUJET: RED RIVER AT EMERSON MONTHLY WATER QUALITY REPORT FOR DECEMBER 1984.

Attached please find the December 1984 monthly water quality report for the Red River at Emerson.

for/ V. T. Chacko
District Resource Officer.

DISTRIBUTION

L. Breimhurst
D. Brown
D. A. Davis
I. Dickstein
H. C. R. Gavin
D. R. Kimmett
L. G. Moore
M. Morelli
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L. D. Sprenger
K. Thomson
D. M. Wagner
File

RED RIVER MONITOR, EMERSON, MANITOBA.

Daily mean values - December 1984 .

Day	TEMP. (C.)	pH	D.O. (mg/L)	Conductivity (umhos/cm)	Chlorides (mg/L)	Flow Rate $m^3 sec^{-1}$
1	0.9	8.3	10.6	790	67.6	49.7
2	0.9	8.3	10.6	819	61.6	50.2
3	0.6	8.2	11.0	833	58.2	49.6
4	0.4	8.2	10.9	868	63.0	48.4
5	0.4	8.2	11.3	939	72.6	47.3
6	0.4	8.2	11.4	953	74.4	44.1
7	0.4	8.2	11.1	920	71.6	39.3
8	0.4	8.3	11.5	920	72.4	34.1
9	0.4	8.3	11.3	905	70.6	29.7
10	0.4	8.3	11.3	902	70.8	26.0
11	0.1	8.3	11.6	910	72.6	24.8
12	0.2	8.2	11.3	936	76.0	24.0
13	0.2	8.2	11.3	936	76.0	28.3
14	0.2	8.2	11.6	963	79.0	32.8
15	0.2	8.2	11.5	948	70.8	39.5
16	0.2	8.2	11.6	829	65.8	44.1
17	0.1	8.2	11.5	810	55.6	50.0
18	0.2	8.2	11.5	752	49.2	49.1
19	0.1	8.2	11.5	740	48.6	48.2
20	0.1	8.2	11.5	734	48.0	47.3
21	0.1	8.2	11.9	706	45.6	46.8
22	0.1	8.2	11.3	694	43.4	46.4
23	0.1	8.2	11.5	691	44.2	45.9
24	0.1	8.1	11.6	708	48.6	45.0
25	0.1	8.1	11.5	698	49.2	44.1
26	0.1	8.1	11.5	687	48.8	43.6
27	0.1	8.1	11.1	687	47.2	42.7
28	0.1	8.1	11.1	687	47.2	41.8
29	0.1	8.1	11.5	687	48.8	41.4
30	0.1	8.1	11.3	684	38.0	40.4
31	0.1	8.1	11.5	657	37.0	39.5
Monthly Average:	0.3	8.2	11.4	806	58.8	41.4

Long term mean monthly flow ($m^3 sec^{-1}$)---------- 25.8

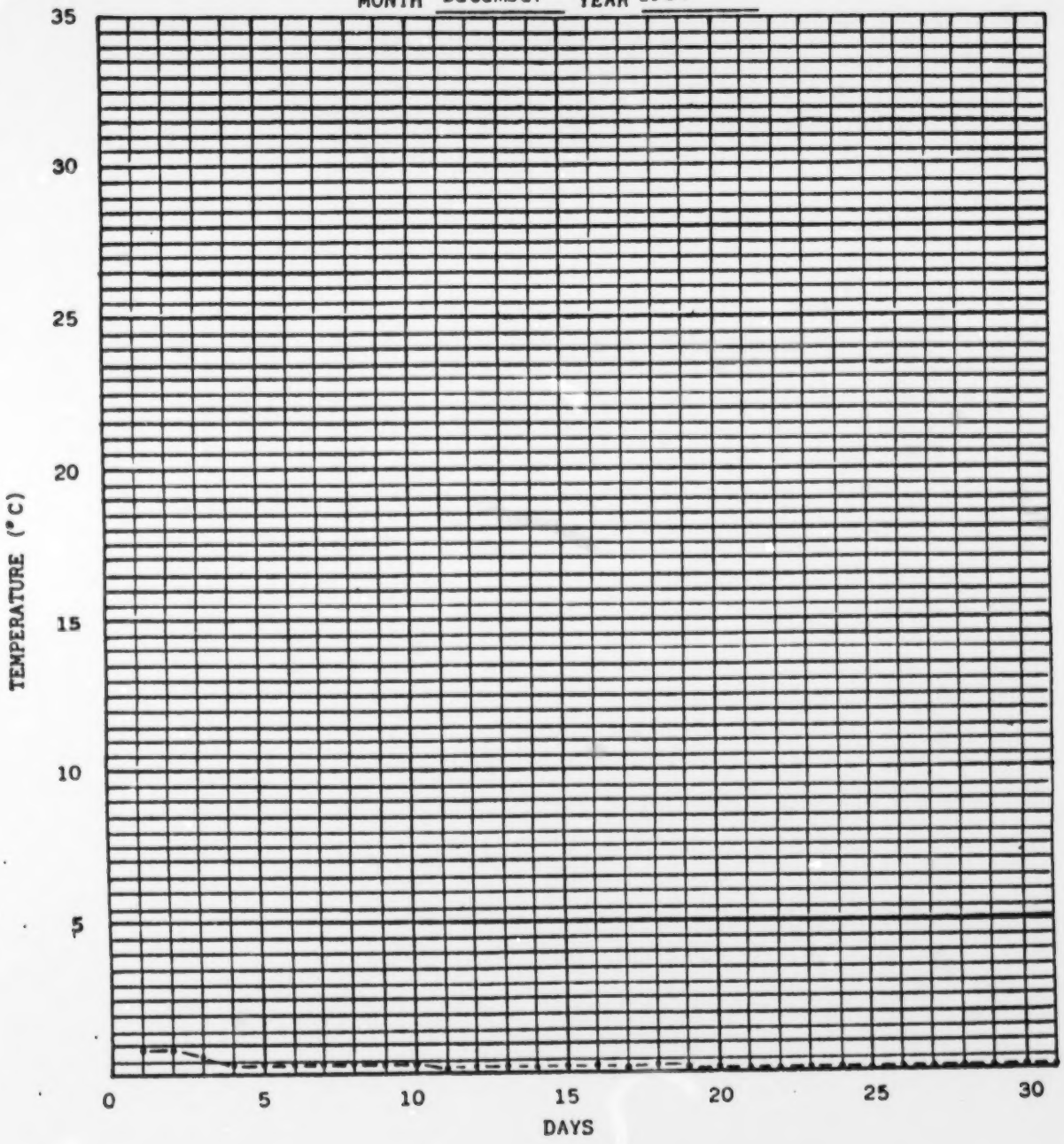
COMMENTS:

The total dissolved solids(approximated from conductivity) continued to be above the I. J. C. objectives of 500mg/L, until the middle of the month. Then, with an increased discharge, the conductivity and chlorides started to decline. The dissolved oxygen continued to be near the saturation point.

The monthly grab sample data are not available at this time.

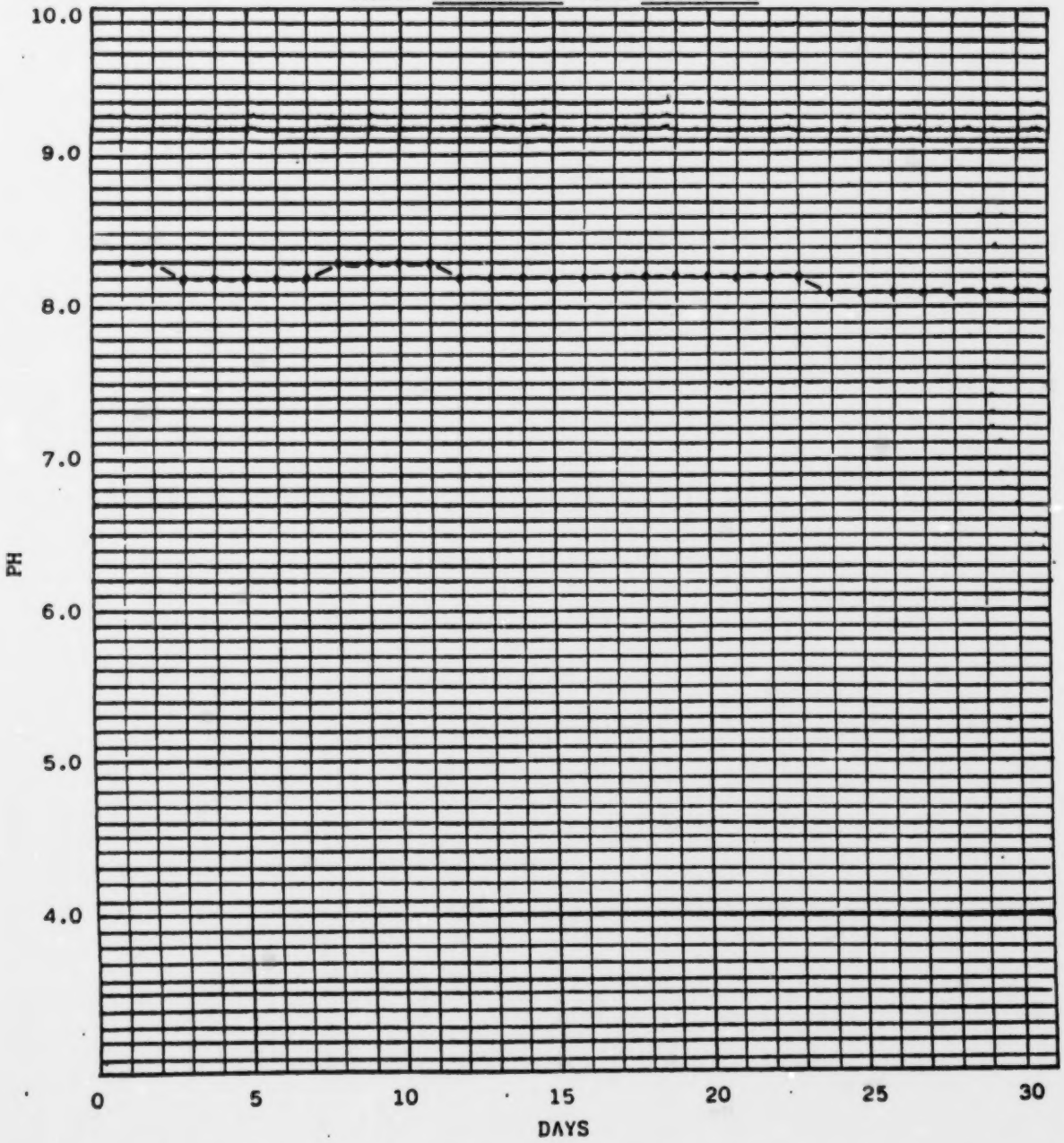
RED RIVER AT EMERSON MANITOBA

MONTH December YEAR 1984



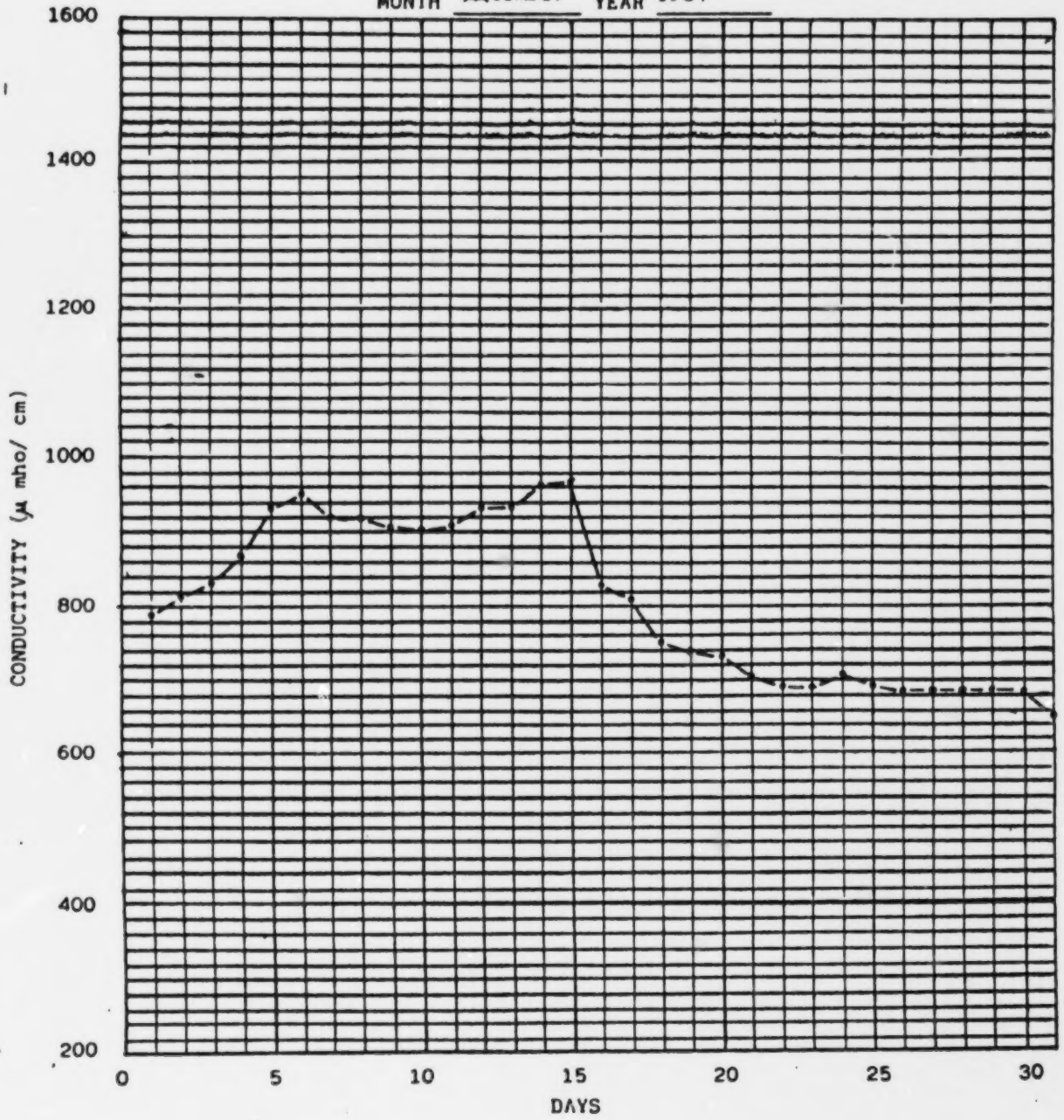
RED RIVER AT EMERSON MANITOBA

MONTH December YEAR 1984



RED RIVER AT EMERSON MANITOBA

MONTH December YEAR 1984



RED RIVER AT EMERSON MANITOBA

MONTH December YEAR 1984